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TECHNICAL REPORT

U.S. - U.S.S.R. Technical Exchange Program

Smokejumping - Rappelling

October 1976

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TECHNICAL REPORT

U.S. - U.S.S.R. Technical Exchange Program

Smokejumping - Rappelling

October 1976

BY

William D. Moody

U.S. Forest Service

Region 6 - Pacific Northwest Region

North Cascades Smokejumper Base

Okanogan National Forest

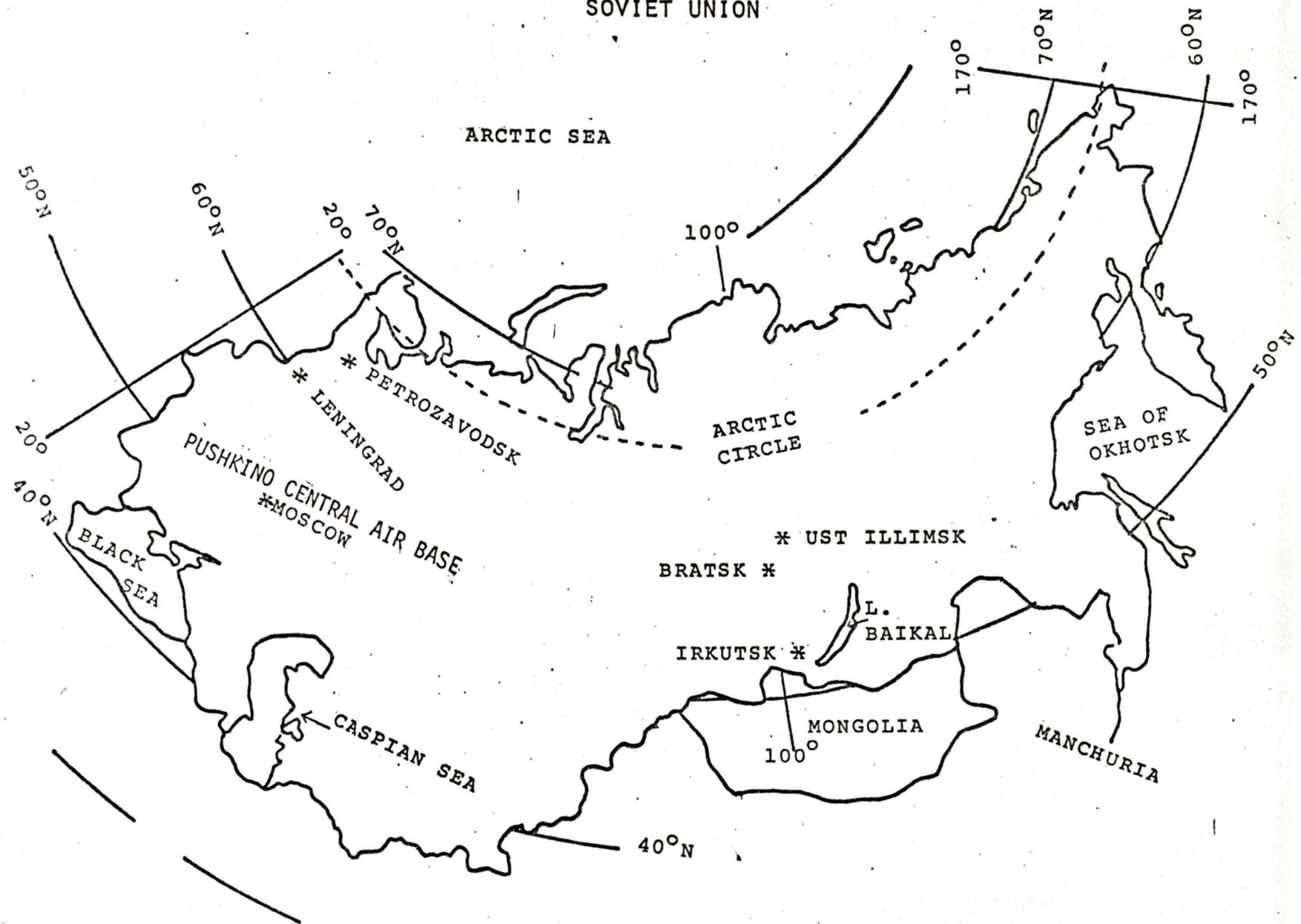
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SOVIET UNION



I.

INTRODUCTION - SOVIET SMOKEJUMPER - RAPPELLING PROGRAMS

The Soviet Union, stretching approximately 3000 miles from north to south and 7000 miles from east to west, possesses approximately one-third of the world's forest resources. The "Taiga" forest, composed of pure and mixed stands of Birch, Aspen, Siberian Larch and Scotch Pine covers the vast expanses of the flat to rolling Russian landscape. To protect this vast, largely remote important natural resource, the Soviets, in 1947, developed a smokejumper program. In 1961 the Soviets initiated a helicopter rappelling program to bolster their aerial fire suppression capabilities. Today the Soviet smokejumper-rappelling programs continues to expand. In 1976 these programs employ approximately 500 fixed wing aircraft and helicopters, 2600 smokejumpers and 5000 rappellers.

Organization

Smokejumpers and rappellers, interregional shared resources, are "controlled" by the national coordinating and training center at Pushkino, (referred to as the Central Air Base) located near Moscow. Nationally the smokejumper-rappeller forces are distributed throughout the seventeen (17) regions, including the Central Base at Pushkino (see Organization Chart Exhibit 1). Each region, except Pushkino, has a regional air base. Each region in turn has zone air bases and operational division air bases (see Organizational Chart Exhibit 2). Throughout the Soviet Union there are approximately 260 temporary or permanent smokejumper or rappeller bases or combined jumper-rappeller operational bases. In addition there are approximately 50 aerial observation bases.

The jumpers-rappellers and support personnel are administratively assigned to, and work for, their respective "region", zone or operational division. A typical operational division base would include a Chief and Assistant Chief, Pilot-Observer (Soviet counterpart to the U.S. Forest Service squadleader-spotter), Senior Instructor and Instructors (supervisory personnel-squadleader), smokejumpers and rappellers, one or two smokejumper aircraft, and one or two rappelling helicopters. Further discussion regarding personnel, their training, qualifications and duties will be discussed in the section on Operational Division Organization.

Role of Pushkino

As previously mentioned, the Central Air Base at Pushkino is the national coordinating and training center for aerial shared resources (similar to BIFC's role in the USA.) Pushkino is responsible for accessing the national fire situation, establishing situation priorities, and moving the smokejumper-rappeller resources and aircraft to the areas of most critical need.

Specialized training of key aerial fire suppression personnel, including the Pilot-Observer (spotters), is conducted at Pushkino. Pushkino also assumes a strong leadership role in the smokejumper-rappelling programs, standard operating procedures, training plan, equipment development programs, etc.

Fire Season

Due to the vast expanse of latitude the Soviet Union fire season lasts from early March until approximately early November. The Far East Region, northwest of Japan, has a spring season from March until May and a fall season - somewhat similar to our Region 8 fire season. During this time jumpers and rappellers from the regions to the west are detailed to the Far East. In most of the other areas of the Soviet Union the fire season begins in late April and extends until late September.

Fire Cause

It's difficult to compare number of fires between the Soviet Union and the United States but we can say that the Soviet Union does have a heavy fire load. Due to the remoteness, lack of fixed detection stations in most areas and "let burn - unsurveyed" areas in the tundra areas of the north-eastern Soviet Union, it is difficult to determine accurately the number of fires and the exact cause of fires. Nationwide, approximately 8% of the known fires are lightning caused. In some of the regions lightning starts around 20% of the fires.

II.

THE SMOKEJUMPER PROGRAM

Although the United States and the Soviet Union are thousands of miles apart and our two nations have never shared technical smoke-jumping information before, there exists some remarkable similarities in the two programs, especially in terms of basic training and standard operating procedures. We have both developed equipment to safely and efficiently accomplish our primary objective - to safely deliver a fireman to the fire via parachute. Despite the similarities, there exists enough differences in the respective programs in terms of equipment design, how mission objectives are accomplished, etc., to warrant a detailed examination of the Soviet smokejumper program.

- A. Recruitment The Soviet Union, in 1976, employed 2,600 "permanent full time" smokejumpers. Smokejumping is a "career job" but through retirement or "change of occupation" hundreds of jobs are created annually. Job vacancies are generally advertised in the local newspaper and positions are filled on a "first come, first serve" basis. The initial newspaper advertisement does not always yield enough applicants. When there are an excessive number of applicants the "overflow" may be recruited for the more remote bases where recruitment is sometimes a problem.

Applicants must be at least 18 years old and must have completed the eighth grade. All applicants must pass a physical examination. There are no height or weight restrictions, but the medical examination requires a hand grip test and breathing-respiration test. Personnel recently discharged from the military (compulsory military service between ages 18-20) are preferred. The reason being that these personnel are generally in better physical condition and have complete, up-to-date physical data. Applicants with a poor physical record are rejected. No previous fire suppression experience is required (this is one reason why the rookie smokejumper training program lasts three months.)

Of the 2600 smokejumpers ten are female.

NOTE: While visiting the Irkutsk Regional Base I was introduced to Maria Kopilov, in charge of the para-loft operation. I noted Maria was wearing a "200 Jump Pin". Upon questioning I found out that Maria began sport jumping in 1945 and became a smoke-jumper in 1948. She was one of the Soviet Union's first female smokejumpers and was the first female smokejumper instructor. Maria retired from jumping with 255 sport, fire and training jumps. Her husband, Michail, retired in 1965 with 729 sport, fire and training jumps.

NOTE: Soviet smokejumpers, usually during the off-season, have sport parachute competition between bases and also compete for positions on the Soviet Sport Parachute Team (international competition).

Once selected for the program the applicant must successfully complete the three month basic training course. Prior to jumping the applicant must pass a physical test consisting of the following items.

1. Run 3 kilometers (1.8 miles) in less than 15 minutes.
2. Do 7 chinups.
3. Do 21 pushups.
4. Climb a 10 meter (32½ ft.) rope.
5. Climb a 60ft. tree with spurs.

Retention in the program is dependent on successful completion of the physical test as well as general performance during the basic training. Experienced jumpers are required to have a medical examination annually and must pass the physical test outlined above prior to making live jumps. During the "off-season" jumpers are employed in non-fire suppression forestry related work until training begins the following spring.

B. Salary

Note: Soviet ruble equals about \$1.34 in U.S. money (Oct. 1976). By Soviet standards smokejumpers make a fairly good salary. It's difficult to compare "dollar equivalents" since the Soviet ruble goes much further in the Soviet economy. An inexperienced rookie jumper makes about 220 - 230 rubles per month including his average "hazard pay" bonus.

Salary is determined by, and increases:

- (1) with additional experience.
- (2) with the number of jumps made during the pay period.
- (3) with rating within the organization (rookie jumper, instructor, senior instructor, etc).
- (4) if the person is also a qualified rappeller.

The base week is 41 hours with overtime paid at the straight time rate. The base salary varies throughout the nation depending on the base's remoteness and other environmental conditions. For salary computation, Moscow is given a salary value of 1.0. Some of the more remote bases in Siberia pay salaries of up to 2.1 times that of the Moscow area.

Hazard pay is paid for all jumps including routine training jumps. Hazard pay for jumps made in open areas is 7.5 rubles while timber jumps pay 17.5 rubles. In an average year a jumper will make between 20 and 30 jumps including an average of about 10 fire jumps, qualifying training jumps and proficiency jumps.

In addition to direct compensation, jumpers also get additional vacation days, depending on the number of jumps made during a season. Like persons in other Soviet occupations, smokejumpers get approximately 6 to 8 weeks vacation per year.

C. Retirement

If a jumper has made 15 jumps a year for 17 years he is eligible for full retirement of about 120 rubles per month. When eligible for retirement the jumper has the option of continuing to jump, transferring to a different job, (usually fire suppression related), or full retirement. Most jumpers elect retirement when they fulfil the eligibility requirements.

D. Cross-Training - Smokejumper Rappeller

Smokejumpers are recruited primarily for the job of smokejumping, however, some jumpers, after one year of smokejumping experience, receive helicopter rappelling training and may be used as a smokejumper or rappeller during the fire season. Generally, however, the person will serve either as a smokejumper or rappeller for that fire season. Rappelling qualified jumpers receive additional salary. Most of the rappellers are not cross-trained to jump.

E. Operational Division-Organization & Career Development
(See Exhibit 1 and 2)

The primary personnel assigned to the basic operational unit, the Operational Division, include jumpers and/or rappellers, instructors, senior instructors, pilot observer(s), an assistant or Deputy Chief, a Chief and the pilots. The basic qualifications and duties for each are as follows.

1. Chief - A professional forester, is generally a non-jumper or non-rappeller who has had extensive training in fire and aerial fire suppression. The Chief is the Base Manager or Aerial Project Foreman.
2. Deputy Chief - Similar to the Chief except usually has less experience. This position helps qualify him for the "Chief" position.
3. Pilot-Observer (spotter) - The pilot-observer, or sometimes referred to as the Forest Navigator, is a professional forester and generally does not have jump or rappell experience. The Pilot observer's primary duties include the basic responsibilities of our Forest Service spotter - to communicate on the radio, to navigate (key job in the vast, remote Soviet forests) and is the spotter.

The Pilot observer does not jump or rappell. In addition to his professional forestry training the potential pilot observer receives seven months specialized training at Pushkino. Courses include Forest navigation, communications, aerial fire recon, "air attack skills", spotting techniques and regulations, air operation regulations, etc. To become certified the trainee must pass a written examination and a medical examination. The Pilot Observer earns a certificate and the title of Forest Navigator. After two years experience, and successfully passing another written examination, the beginning Third-Class Forest Navigator graduates to Second-Class Forest Navigator. After a total of five years experience, re-examination and inspection, the Second-Class Forest Navigator graduates to First-Class Forest Navigator. Written examinations and medical examinations are required annually for re-certification. The Pilot Observer (Forest Navigator) is allowed two regulation violations during his career before he loses his certification (violations generally pertain to deploying jumpers or rappellers under unsafe conditions, etc., counter to established policy). In terms of career development the Pilot Observer may move into Deputy Chief and Chief positions in the Operational Division, Zone, Regional Base and eventually into a position at Pushkino. Pilot Observers receive premium pay and bonus vacation for each flight hour, and are entitled to early retirement if they fly over 300 hrs. per year. (Each year, over 300 hours counts as 1½ years).

4. Senior Instructor - The highest position a smokejumper can attain without a professional forestry degree is Senior Instructor (U.S. Forest Service Smokejumper Foremen). Presently, Senior Instructors must also be graduates of a two and one-half year technical forestry school. The Senior Instructor is a highly experienced smokejumper who serves as a smokejumper foreman or squadleader and trains new smokejumpers. He does not spot but may advise the Pilot Observer on "jump conditions", spot selection etc. The Senior Instructor usually throws the drift streamers upon command of the Pilot Observer, opens and shuts the "in-flight" jump door, safety checks the jumpers before boarding the aircraft and prior to exiting, retrieves the static line, drops cargo and jumps last.

5. Instructor - Without additional professional or technical forestry training, the smokejumper may become an Instructor. The instructor is basically a smokejumper training instructor-squadleader. On a typical mission the Instructor will jump first (or the senior instructor if there are two senior instructors aboard), and supervise the crew on the fire. The ratio of instructors to jumpers is 6 to 8 jumpers to each supervisory smokejumper.
6. Senior Smokejumper - Experienced jumpers who have demonstrated their competence are certified Senior Smokejumpers.
7. Smokejumper - Beginning smokejumpers and "experienced" smokejumpers who have not reached certain experience or competence levels are termed "smokejumpers".

Pilot Observers, smokejumpers and instructors are re-certified annually. Each person is presented his certificate (passport style) listing his position, date of certification, etc. The rappelling personnel are essentially the same as the smokejumper personnel in terms of basic responsibilities, organizational positions.

F. Smokejumper Training

(NOTE:) Although I tried very hard to get a training manual and course subject outline I never received these materials. Hopefully, they will be sent to us. If so, we will distribute copies to each base.

During the late fall and winter months smokejumper recruits receive three months of basic smokejumper training at their respective Regional Base. The course includes approximately one month of fireman training and two months jump training. Regional Air Base training is followed by practical inspection at an Operational Division Base. Experienced men receive one month refresher training at their respective Operational Division Base. All instructors train annually at regional bases and/or Pushkino. National training standards and plans are developed at Pushkino. Workshops made up of base chiefs, pilot observers, senior instructors and Central Air Base personnel develop and update plans and procedures. There is a high degree of standardization among units but approvals to "deviate" are given to units with "innovative ideas" that may benefit the smokejumper program.

At the unit level there is strict adherence to lesson plans and procedures.

Standard Smokejumper training includes:

1. Basic Fireman Training

- a. Fire behavior.
- b. Fire suppression techniques.
- c. Fire suppression strategy.
- d. Use of water pumps and chainsaws.
- e. Use of hand tools.
- f. Use of fireline explosives.
- g. First Aid.
- h. Radio communication and ground visual signals.

NOTE: I assume other fireman related subjects are included in Basic Fireman Training. Approximately two-thirds of the total basic smokejumper course is jump training.

2. Training Equipment

Probably the greatest deficiency in the Soviet jumper program is lack of adequate ground training devices or equipment. The Soviets recognize this.

Ground training equipment consists of:

- a. A parachute manipulation device where the jumper sits in a harness and maneuvers the parachute toggles under command of the instructor.
- b. A wooden platform with a wood frame door. This serves as a "mockup" exit device and landing roll platform.
- c. An overhead ladder.
- d. Wooden pole frame for letdowns.

The Soviets do not have jump towers. All exits are made using a door frame on an elevated platform. Despite the lack of modern training equipment the Soviet jumper appears to be well trained and accomplishes his mission with the same proficiency as his U.S. counterpart.

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3. Pre-jump Ground Training

Soviet ground training includes:

- a. Parachute manipulation.
- b. Timber letdown.
- c. Aircraft exit procedures.
- d. Landing rolls.
- e. Physical training (discussed in detail later).
- f. Tree climbing and parachute retrieving.

4. Live-jump Training

After achieving a high level of competence in the ground training phase, and after passing the physical strength test, the trainee graduates to the live-jump phase of training.

The "live-jumps" requirements are:

- a. Rookie Smokejumpers.
 - (1) 12 training jumps.
 - (2) 2 proficiency jumps per month.
- b. Experienced Smokejumpers.
 - (1) 6-8 refresher jumps.
 - (2) One (1) proficiency jump per month.

Proficiency jumps are not required during the "off-season." Some jumpers are involved in winter rescue operations and remain proficient year around. As previously mentioned some smokejumpers participate in sport parachuting, usually in the "off-season," and compete for the national sport parachute team.

The Soviets do not require a water landing emergency training jump. Each jumper is required annually to deploy his emergency chute on one of the training jumps.

From what I could observe the Soviet jumpers are very proficient chute handlers.

5. Parachute Rigger Training

Most rigging is done on the ground; often times in the field at a remote base. Most jumpers are trained to rig their own main and reserve chute.

6. Physical Training (fire season)

Prior to making live jumps, each jumper must pass the physical test outlined on page 2. Smokejumpers, both rookie and experienced jump personnel, are required to participate in at least one hour of physical training each day, five days a week. Some units require two hours each day. This includes physical training, ground station refresher training, landing roll training and a recreational game, (soccer or volleyball). Some units stress more "individualized" physical training.

A typical two hour physical training session includes:

- a. Foot-ankle rotation, flexibility exercise.
- b. Knee rotation, flexibility exercise.
- c. Jump (spring) in place vertically and extend.
- d. Jump and twist-rotating 90°
- e. Jump and twist-rotating 180°
- f. Jump and twist-rotating 360°
- g. Knee bend - touch toe exercise.
- h. Run .6 to 1.8 miles.
- i. Go through overhead ladder (on 45° slant).
- j. Pullups.
- k. Pushups.
- l. Trampoline exercises.
- m. Landing rolls.
- n. Chute manipulation simulator (occasionally).
- o. Volleyball or soccer.

G. Smokejumper Aircraft and Pilots

Most of the 200 fixed wing aircraft used in aerial fire suppression activities are smoke-jumper aircraft. All aircraft are owned, operated, and maintained by Aeroflot, the national airlines. By December each year the Central Base determines the number of aircraft it plans to use for the next fire season. The Central Base submits its needs to the Civil Aviation Division in December. Aircraft are procured on a projected "guarantee period" but the use period can be extended, and, if needed, additional aircraft may be brought into service to meet overload situations.

1. Pilots

Pilots are provided by the Civil Aviation Division of Aeroflot. Smokejumper pilots must have at least three years pilot experience, be a graduate of the Civil Aviation College, and receive 16 hours of specialized "smokejumper pilot" training. On the larger aircraft requiring two pilots, the "trainee" receives OJT training while serving as co-pilot. Many of the pilots return to the same units each year. The pilot arrives at the operational unit "fully trained" but will receive additional proficiency during live-jump training. Fixed wing pilots flying over 300 hours per year are eligible for early retirement (each year equals one and one-half years).

2. Aircraft

Three different aircraft are used for the smokejumper mission.

These aircraft are:

a. AN-2

- (1) Bi-wing built in 1930's.
- (2) Single engine - 1500 horsepower reciprocal with four bladed propeller.
- (3) Maximum speed - 144 mph.
- (4) Cargo drop speed - 108 mph.
- (5) Jump speed - 100 mph.
- (6) Number of jumpers - 6 to 8.
- (7) Range with jumpers/cargo - 8 hrs. plus 30 minutes reserve.
- (8) Rental cost per hour - \$147 (approximate) including pilot, fuel and maintenance.
- (9) Single pilot.

NOTE: Used extensively for smokejumper patrol-detection flights. Excellent jump aircraft, highly maneuverable.

b. EL-14

- (1) Similar to a DC-4.
- (2) Twin engine - reciprocal.
- (3) Maximum speed - 204 mph.

- (4) Cargo drop speed - 108 mph. (not real sure).
- (5) Jump speed - 100 mph.
- (6) Number of jumpers - 20.
- (7) Range with jumpers/cargo - 4½ hrs. plus 30 minutes reserve.
- (8) Rental cost per hr. \$402 (approximately) including pilot, fuel and maintenance.
- (9) Two pilots.
- (10) Special feature - spotter's bubble

c. AN-24

- (1) Looks like an F-27 turbo-prop.
- (2) Twin engine turbine.
- (3) Maximum speed - 270 mph.
- (4) Cargo drop speed - 108 mph (not real sure).
- (5) Jump speed - 100 mph.
- (6) Number of jumpers - 30
- (7) Range with jumpers and cargo - 3½ hours plus 30 minutes reserve.
- (8) Rental cost per hour - \$725 (approximate) including pilot, fuel and maintenance.
- (9) Two pilots.
- (10) Special feature - spotter's bubble.

All aircraft leave the jump-exit door on during flight, opening it immediately before dropping streamers or jumpers. A required feature on all aircraft is an electronic altitude measuring instrument. The pilot and pilot observer use it to determine jump altitude. (This altimeter is accurate to 50 ft. It would be an excellent device for us to require on our jump aircraft).

H. Smokejumper Equipment

1. Main parachutes.

At the present time three main parachute systems are being used throughout the Soviet Union. Systems include a "conventional" static line maneuverable chute, a free-fall maneuverable chute and the recently developed combination static-line, free-fall "Forester-Parachute". The Forester was introduced in 1968 and is now used throughout the Soviet Union. Only 50-60% of the main parachutes are "Foresters, but within a few years the "Forester conversion" should be completed. This report will discuss only the Forester parachute.

Jumpers are usually assigned a parachute for the season. It's his responsibility to care for and rig his own parachute. When a chute is damaged it is replaced from the inventory.

NOTE: I received ground training on the "Forester" and had an opportunity to jump it once. I feel that we should consider some of its features as we develop our new smokejumper parachute. We have been given a "Forester Parachute". It will be presented to us by the Soviet delegation when it visits the United States in 1977. A technical manual is supposed to be sent to me soon. The slide presentation will discuss the chute in detail.

2. The "Lesnik" Forester Parachute - General Information.
(See Exhibit 3).

- a. Size - Unsure, approximately 28 ft. at skirt
58 sq. meters.
- b. Shape - Flat Circular, 28 gores -
with stablization panels.
28 gores.
- c. Material - all nylon with three different
porosity cloths.
 - (1) Forward areas - "0" porosity.
 - (2) Sides - "medium" porosity.
 - (3) Back area - relatively high porosity.
- d. Colors vary, combination of three to four
colors (white, red, blue and yellow).
- e. Controls - One toggle (color coded red) on
each back riser. Toggle control line branches
(6 smaller lines to the slots) at the skirt.
- f. Modifications - 4 vertical slots, rear and
sides plus "cut-away" area in the rear skirt -
3 gores wide. (see diagram-Exhibit 3).
- g. Shroudline length - approximately 22 feet.
- h. Shroudline tensile strength - 330 lbs.
- i. Operational design weight - 225 lb. jumper.
- j. Canopy-harness-container weight - 30 lbs.
(approximate).
- k. Cost (including harness and container) - \$525.
- l. Canopy performance.
 - (1) Descent rate - 16ft. per second.
 - (2) 360° turn - 5-6 seconds.
 - (3) Forward speed - 9 mph with toggles full-up.
 - (4) Vertical descent-no wind, toggles 1/3-1/2
down.
 - (5) Reverse speed - 5mph with toggles full down.

NOTE: An oscillation is often set up coming out of a fast turn. This is corrected by returning both toggles to up-position.

- m. Canopy maximum exit speed - 150 mph.
- n. Deployment system-combination:
 - (1) Static line - 4ft. long.
 - (2) Pilot chute.
 - (3) Ripcord - manual pull.
 - (4) Sleeve.
 - (5) Automatic timer (backup system).
- o. Lapse time normal deployment - approximately 7-8 seconds.
- p. Altitude required for normal deployment - 475 ft.
- q. Ripcord pull required to activate system - 35 lb. pull.
- r. Deployment sequence. (See Exhibit 4)
 - (1) Hookup to static line cable and exit.
 - (2) Exit and four-foot static line deploys pilot chute (approximately 6 ft. diameter).
 - (3) Static line pull also activates automatic timing device pre-set at 5 seconds.
 - (4) Free fall - stabilized in vertical position by pilot chute.
 - (5) After total lapse time of 5 seconds, jumper pulls ripcord (located left front shoulder area).
 - (6) Pilot chute pulls sleeve and canopy out of container.
 - (7) Sleeve is removed.
 - (8) Parachute deploys.

The total deployment time to full opening takes about 7-8 seconds during the approximately 475 foot fall.

In the event that the jumper does not pull his rip cord the automatic timer will "release" the pilot chute and deploy the main canopy automatically. The timer is backed up with an aneroid barometric pressure system. The jumper can "override" the automatic timer anytime if he elects to pull the rip cord before the five second period. There have been no recorded "timer failures."

The Soviets selected this system over other deployment systems because they feel that the pilot chute stabilizes the jumpers in optimum position (vertical) for deployment and thus reduces the chance of deployment malfunctions. There have been no reported malfunctions with the "Forester." Periodically all timing devices are sent to the Irkutsk Regional Base for a "timing check" and necessary adjustment and repair.

3. Forester Parachute: Rigging and Maintenance

The "Forester" chute life is 400 jumps and/or 12 years use. An experienced rigger can "field rig" the chute in about 20 minutes. Color coded marks on the shroud line identify which lines should be rigged first, how far the shroud lines should be stowed, etc. Color coding assists the rigger and reduces the chance of rigging errors.

Lines are stowed on the sleeve similar to the stows on the FS-10 D-Bag.

We have a photographic slide sequence of rigging the "Forester," so I will not attempt to discuss the rigging procedure in this report. A rigging manual has been requested.

Chutes with minor damage are repaired at the Operational Division Base. Chutes requiring major repair are sent to the Regional Base where they are repaired during the winter.

4. Auxiliary (Reserve) Parachute

The reserve parachute used with the Forester system is nylon flat circular canopy.

- (a) Size - 50 sq. meters (about 22-24 ft. diameter).
- (b) Weight - 11½ lbs.
- (c) Descent rate - 23 ft. per second.
- (d) Shroud line length - 19½ ft.
- (e) Deployment - Center pull rip cord using (See Exhibit 5), right hand. A "springless pilot chute" with scoops (Vane type) assists the reserve chute deployment.
- (f) Special canopy feature - the reserve chute has a combination of "0" - porosity and 1.1 rip-stop material. "0" porosity material is used in the skirt and apex while standard ripstop material is used in the central canopy area.

5. Parachute Rigging Regulations

Regulations require main and auxiliary (reserve) parachute to be inspected and repacked every 30 days. The parachute rigger maintenance regulations are established and enforced by the smoke-jumper organization, not the Civil Aviation Division.

Parachute riggers are trained and certified by the unit's Senior Instructor.

Each canopy has a record, and parachute rigging logs are carefully maintained.

6. "Forester System" Harness

The "Forester" harness is somewhat conventional and can best be discussed during the slide presentation. The harness does have a canopy release device that can "jettison" the main canopy under emergency situations. The release has a color coded safety lock.

7. Jump Suit

The jump suit is a black cotton, canvas one-piece suit with full length zippers in the front. The suit has "heel stirrups" similar to the U.S. smokejumper pants. The jacket collar is not as high as the U.S. jacket collar. The Soviet suit is padded only from the waist down. There are no leg or other pockets on the suit. The jump suits are manufactured by a garment factory, not by jumpers personnel. The suit does not give nearly as much protection as our Forest Service suit.

8. Smokejumper Accessory Equipment

a. Letdown Rope Packet

The letdown rope "packet" is worn under the reserve chute. The packet includes a 94 ft. rope (1 inch flat nylon rope with a 1540 lb. tensile strength), a small axe for retrieving the chute, a set of short gaff spurs and a climbing rope (webbing). The snap on the end of the descent device is attached to an "O" ring on the jump suit prior to jumping. A mechanical letdown device (see Exhibit 6), is used to make the letdown. The letdown rope is anchored to the tree or the parachute riser.

b. Helmet

The jump helmet is sturdy plastic or fiber glass type hard hat with a detachable mask. The wire screen on the mask is a very fine mesh and visibility is somewhat impaired as compared with the U.S. smokejumper mask.

c. Packout Bag

An OD colored cotton packout bag is standard equipment. Basic jump gear weighs approximately 46 lbs.

d. Jump Gloves

Jump gloves are required, and same standard glove is used for both jumping and rappelling. The glove is a tight fitting, relatively thin (sensitive) glove.

e. Jump Boots

A standard black "pullover" knee-high waterproof leather boot is issued to each jumper. The boot is similar to a "fishing boot" - no laces. To provide ankle support the jumper wraps his ankle with an athletic ankle wrap.

f. Drift Streamers (see Exhibit 6)

Drift streamers, very similar to ours, are used to calculate wind drift. The streamers are 10 inches wide by 15 ft. long and are weighted with a 1½ ounce piece of rod/wire, 8¼ in. in length.

NOTE: Construction length is 16 ft. of crepe paper. One foot is rolled up to "house" the metal rod. The streamers are made of two pieces of crepe paper. The two lengths of crepe paper are different colors and are overlapped and stitched. Instead of taping the weighted end, the end is stitched. Streamers come in several colors including (1) white and pink (2) light blue and pink (3) green and brown. The Soviet jumpers and pilot observers seemed satisfied with the accuracy (descent weight and true indication of wind drift). From my observations the streamers appeared to be very accurate.

Spotting principles, procedures and theory using the drift streamers are almost identical to the U.S. Forest Service program.

g. Signaling Device (Ground-to-Air)

Instead of using ground visual streamers to indicate that the "crew landed okay," that more jumpers should not be dropped, etc., the Soviet crew leader shoots a colored flare into the air. The situation determines whether a red or green flare is fired.

h. Personal Portable Radio

Primary ground-to-air communications is accomplished with a one channel personal portable "ultra wave" radio. The radio is about 5 inches high by 3 inches wide by 1 inch thick. The antenna is collapsible. The small battery (connected to the radio by a wire) is put in your pocket.

Average ground-to-ground range is 6-9 miles, while ground-to-air range is about 15 miles. Dispatch centers and aircraft have long range multi-channel "forest" and "airnet" radios.

i. Cargo Chutes

Cargo chutes are converted condemned personnel chutes. Most appeared to be condemned reserve parachutes. Small special purpose chutes are also used; i.e., dropping small box with dynamite caps. Each cargo chute has its own static line. For all practical purposes the cargo parachute bag, static line, etc. is the same as those used in the U.S. The cargo chutes are secured in place on the bundle. Long lines are not used.

j. Cargo Bag

For the smokejumper, mission cargo is divided into two general categories: (1) fire equipment and (2) camp and personal equipment.

NOTE: Under some conditions the fire equipment is dropped in a different location than the camp equipment.

A standard heavy duty cotton cargo bag, 39 inches high by 20 inches wide by 20 inches deep is used. The bag has built in nylon webbing harness to add support to the bag and for attaching the parachute to. The bag is designed for a 176 pound load.

1. Fire Suppression Equipment & Supplies

1. Fire Pack Contents (contained in both the cargo bags).
 - a. Single bit axes - 16 inch handle.
 - b. Fire shovels (head relatively flat).
 - c. Hand saw.
 - d. Tent
 - e. Sleeping bags.
 - f. Chow ("conventional chow" - not rations or freeze dry).
 - g. Camp cooking gear.
 - h. First aid kit.
 - i. Fusees (similar to U.S. type).

NOTE: Drinking water is generally not "dropped," the jumper relies on "local water sources." Due to their northerly latitude and the long days flashlights are generally not included in the fire pack. A combination tool (similar to our pulaski), was used in the past but is no longer used. The "spruce bow" is a commonly used initial attack tool. Hardhats are generally not worn on the fireline. The jumper will use his jump helmet if a hardhat is needed. Fire resistant shirts and pants are not worn.

2. Specialized Fire Equipment

As the situation dictates, specialized equipment is available in the aircraft and is often dropped. Specialized equipment includes:

- a. Chainsaw.
- b. Light weight centrifical pump and hose. Fuel is put in a special container and dropped with the power equipment.
- c. Water bag - approximately 100 or 250 gallon rubber-canvas bag. When water is not available near the fire the bag may be filled (by pump) at a water source and delivered by helicopter sling load to the fire. A fitting in the pump enables the fire fighter to pump directly out of the bag.

- d. Fireline explosives - fireline explosives are used extensively in the Soviet Union and most smokejumpers and rappellers are trained and certified to use fireline explosives. Explosives are carried aboard smoke-jumper-rappeller aircraft. The detonators are dropped separately on a 3 ft. chute. The fireline explosives team consists of six men. The explosive system used consists of a slow fuse ignitor, a primacord initiator, and 250 gram sticks of ammonite. Depending on the ground covered, desired fireline depth, the explosive will be laid on top of the ground in a plastic tube, or individual sticks are placed vertically at intervals in the ground.

A six-man crew can lay 110 yards of explosive in 18 minutes. Average cost is about \$.65 per yard, or \$160-\$180 per kilometer (.6 mile). Fire intensity, flame height, ground cover, etc. determines whether hand tools or explosives (or both) will be the primary initial attack line building tool. Our impression was that explosives are used much more than just hand tools.

J. Policies, Regulations and Standard Operating Procedures

1. Smokejumper-Rappeller Detection Patrols

The forests of the Soviet Union have been zoned by aerial suppression (smokejumper-rappeller) attack zones and ground attack zones. Due to the vastness and remoteness of the Soviet Union aerial detection and attack are primarily used. Each Operational Division establishes smokejumper-rappeller aerial detection patrol routes. As fire danger and risk increases, patrols are intensified. Once a fire is detected it is almost always automatically attacked by the resource discovering the fire. The Soviet version of the Barnes Infrared Fire Spotter is also used on a few smokejumper-rappeller aircraft.

2. Initial Attack Response Time

When the "wings" are on the ground and a fire is reported, Soviet policy requires smoke-jumper and rappellers to be airborne within 30 minutes. Some of the units are not located adjacent to airports. A 15 minute takeoff time was the average response time at the Bratsk Base. - (Located adjacent to the airport).

3. Jumper Squad Size

Depending on the burning conditions, aircraft capacity and other factors, jumpers are divided into squads varying from 3 to 8 jumpers per squad. A minimum of 3 jumpers are dropped on a fire. One man, unless badly needed on a "hot" fire, is assigned to inventorying and retrieving gear while the other crew members attack the fire. As burning conditions increase the minimum number of men comprising the "initial attack squad" increases.

If fireline explosives are to be used, a six-man team(s) is (are) dropped.

4. Regulations: Jump Spot/General Conditions

Once over the fire area the pilot observer, with input from the senior instructor or instructor, selects the jump spot and determines if the mission can be conducted safely. Safety regulations are:

- a. Minimum Jump Altitude - 1950 ft. (as determined electronically).
- b. Maximum Timber Jump Height - 80 ft. timber (if tree timber crowns are touching, jumps may be made into taller timber, however, this is infrequent).
- c. Maximum Ground Wind - Open area - 15mph.
Timber area - 22mph.
- d. Standard Jump Exit Speed - 100mph.

- e. Hazards - No jump
 - (a) Snag areas.
 - (b) Rock outcrop areas.
 - (c) Water.
 - (d) Near large water source,
depending on wind conditions.
 - (e) Logging/logged over areas.
Dried-up swamps may be used.

5. Soviet Jump Country

In general, the Soviet Union appears to be easy jump country. Most of the area is flat to rolling, with only a few areas as rugged as some of our Rocky Mountain area (near Mongolia border). Summer temperatures may reach into the 80's or low 90's.

Ground elevations are generally low with most areas 0-2000 ft. above sea level. The Ural Mountains of the western Soviet Union and some areas of eastern Siberia are 2000-5000 feet above sea level. A few areas along the Mongolian border rise above 5000 feet.

The country has dense, usually mixed stands of Siberian Larch, Scotch Pine, some White Pine and Birch plus some Aspen. Timber jumps are common as there are few large openings. In order to rather consistently land on the ground without damaging his chute, the jumper must be a good chute handler. The "Forester" parachute, with its "reverse" has greatly reduced the number of timber hang-ups and has improved safety.

NOTE: We showed the Soviets several slides of our typical jump country in the Western United States. They were amazed at where we put jumpers. Many expressed that they would not jump in some of our country.

6. Regulations: Miscellaneous

- a. Pre-flight Physical - Before each flight all crew members, including pilot(s), pilot observer, and jumpers/rappellers, are required to have a physical examination by the local doctor (at the base). The physical consists of taking the pulse and "general observation." A pulse of over 90 dis-qualifies the person. A primary concern,

I was told, is "fitness for duty" and indications of recent use of alcohol. Upon completion of the physical, the doctor and the crew member sign an official document certifying fitness for duty.

- b. Use of Alcohol - Crew members may not use alcohol the day before, or the day of a flight.
- c. Number of Jumps Per Day - Jumpers are limited to 2 jumps (any type) per day. Smokejumpers in sport competition are allowed a maximum of 4 jumps per day.

7. Program Safety

We inquired about smokejumper safety statistics but were unable to get any conclusive written or verbal statistics. The Soviets appear to have a similar percentage of minor accidents and injuries, usually ankle or leg type. One source told me that there were 2 to 3 jumper deaths in 1976 but I was unable to verify this or get any details regarding the causes. One supposedly was related to parachute malfunction.

From all indications the "smokejumper pilots and aircraft" have a very good safety record.

In some areas of their training, procedures and equipment, there is a high regard for safety, while in the area of protective equipment, aircraft loading, aircraft jumper safety features, the concern for safety is secondary.

Prior to each flight and prior to exiting the aircraft, the senior instructor carefully checks each jumper. I observed strict adherence to training and standard procedures and techniques. The pilot-observer, riggers, etc. are held very accountable for their areas of responsibility.

K. Smokejumper Mission Sequence

Once airborne the pilot observer is in charge of the mission. He communicates with dispatch and the fire and navigates to the fire. After arriving over the fire the following sequence is followed.

1. Pilot observer, with input from the senior instructor or instructor, selects the jump spot, carefully taking into consideration the "jump spot criteria." In the AN-2, single engine bi-plane, the pilot observer conducts the mission from the right seat next to the pilot. Visability from this position allows him to see the jump spot, to visually direct the aircraft on its flight line and to observe the drift streamers. In the EL-14 and AN-24 the pilot observer is aft of the cockpit. Using a spotter's bubble and intercom he directs the mission.
2. Once the jump spot is selected and the jump altitude of 1950 ft. is verified the pilot observer briefs the pilot on the flight pattern.
3. Drift streamers are dropped.
 - (a) On final, about 5 seconds before arriving over the "streamer release point," a horn signals the senior instructor/instructor to open the exit door (left side). All jump aircraft have "inflight exit doors."
 - (b) Over the release point a second blast on the horn signals release of the streamers.
 - (c) Exit door is closed.
 - (d) Aircraft circles and streamers are read by the pilot observer. In the AN-2 the aircraft circles in a right hand pattern. In the EL-14 and AN-2 the aircraft circles to the side on which the spotter's bubble is located. (I believe it's on the left side).
 - (e) More than one set of streamers may be dropped if conditions warrant.
4. Jumpers are visually checked by instructor.
5. Jumpers hookup to the overhead static line anchor cable.

NOTE: The cable is a $\frac{1}{2}$ inch cable. Aeroflot engineers install and certify the cable. I couldn't find out the design strength of the cable system but was told by one person that it would withstand at least a 1760 lb. pull. The Soviet "Forester" chute probably exerts a "force" of about 50 lbs., enough to deploy the main canopy pilot chute. The "Forester" static line has a tensile strength of 2500 lbs.

6. Jumpers are briefed - aircraft turns on final.
7. Pilot observer directs aircraft.
 - (a) Flight pattern into wind, from the streamers to the spot.
8. Exit alert - approximately 6-8 seconds before arriving over the exit release point, a horn signals the senior instructor/instructor to open the door.
9. Jumpers assume exit position with left foot forward, semi-crouched position and hands on the side of the door. Generally two jumpers exit per pass. Under some conditions one, or a maximum of three jumpers, may exit per pass.
10. Exit signal - After assuming the exit position, and approximately 6-8 seconds after the exit alert signal, a second horn signals the jumpers to exit. The first man is slapped on the left shoulder and he exits. After a two second interval the second man exits.

NOTE: Soviet procedures are to "carry jumpers the full distance of the streamers."

11. Exit position - The exit is a "forceful exit," similar to our military exit. Arms are initially crossed with the right hand, after two to three seconds, gripping the main canopy release ripcord located in the left front shoulder area.
12. Pre-deployment - With the pilot chute stabilizing the jumper he falls in a vertical position. After 5 seconds total lapse time the ripcord is pulled. The automatic timer is also set for 5 seconds should the jumper fail to pull the ripcord.
13. Deployment - After "pulling" the arms are again crossed until the canopy is fully open.
14. Canopy is checked - If a malfunction is observed the reserve chute is deployed in the same manner as we do in the United States.
15. Partner is checked.

16. Minimum maneuvering altitude. Within 150 ft. of the ground the jumper is instructed to turn into the wind and setup for landing. Strong emphasis is made on NO LOW LEVEL TURNS!

NOTE: The toggle control, 0 mph. vertical descent and reverse speed of up to 5 mph (relative speed), is a real asset for low level maneuvering in tight spots and for preparing for ground contact. Although the landing rolls is taught (similar to Parachute Landing Fall), jumpers may make standup landings.

17. Crewboss confirms crews disposition by firing a smoke flare, (green for okay), (red for not okay). Radio communication between the crew and aircraft is established.
18. Cargo is dropped. Cargo dropping procedures are similar to U.S. Forest Service procedures. The cargo dropper does not wear a chute. He wears a harness and is tethered to the overhead static line anchor cable. A 6 or 8 man crew requires 2 cargo bundles, (equipment and camp gear).
19. Senior instructor/instructor jumps last. During the mission the pilot observer remains in the cockpit or near spotter's bubble and the instructor safety checks the jumpers, opens-closes the exit door, retrieves static lines and drops the cargo. After dropping the cargo the aircraft goes to jump altitude and the instructor jumps. The pilot observer, or the co-pilot, retrieves the static line.
20. Final communications with crew - The pilot observer usually determines fire suppression strategy and tactics. A loud speaker is mounted on some aircraft so the pilot observer may direct the "ground activities."

L. Fire Suppression

Tactics and strategy employed by Soviet smoke-jumpers are basically the same as we use in the United States, except for the extensive use of fireline explosives used by the Soviets.

Soviet jumpers generally mop-up the fire, spending usually 2-3 days on a fire. Under some conditions where fire suppression may take several days fresh crews may be jumped, rappelled or "helitacked" in to replace the jumpers.

M. Smokejumper Retrieval

If the fire is within a few miles of a road the jumpers may hike out, usually not more than 5-7 miles.

Since most fires occur in inaccessible areas, helicopters are the primary means of retrieving jumpers and rappellers.

Returning to their base the jumpers quickly repack their chutes and ready their gear for the next fire. Often, the jumper will re-pack his chute in the field.

N. Off-Season Work

Except for the primary overhead, during the off-season, jumpers are reassigned to forestry related work.

In the Bratsk area jumpers are used to jump into "insect infested areas" to obtain data. Jumpers are also used for rescue work.

During the off-season, those jump base personnel remaining at the base do the routine tasks of equipment repair and preparation, recruitment, training and planning.

III. THE HELICOPTER RAPPELLING PROGRAM

Since 1961 the Soviet rappelling program has rapidly expanded. In most areas the jumpers and rappellers work closely together at the same base. The Soviet rappelling program appears to be a very effective program. Rappellers are also used as "conventional helitack" crews if landing areas are available.

A. Recruitment

In 1976 there were approximately 5000 helicopter rappellers stationed throughout the Soviet Union. Position vacancies are advertised in the newspaper. Military personnel are preferred. No previous fire experience is required but prospective rappellers are required to have a medical examination. As mentioned earlier some jumpers are cross-trained as rappellers but not vice-versa. Most rappellers are permanent employees but some "seasonals" are hired. There are no height or weight restrictions.

B. Salary

The rappellers salary is less than that of a jumper but I don't have the exact figure. Salary will vary according to location. In addition to the base salary, rappellers receive a bonus of 5 rubles for each training and operational rappel.

As far as I could determine rappellers do not qualify for early retirement.

C. Career Development

Career development is basically the same as for smokejumpers. Rappellers without additional technical or professional training can advance to the instructor level.

D. Rappeller Training

1. Rookie rappellers receive one to two months training at an Operational Division Base. Approximately two-thirds of the training is fire related and includes basically the same subjects as given to smokejumpers as well as general helitack subjects. One third of the training period is devoted specifically to rappel training. Experienced rappellers also train at the Operational Base. Rappelling personnel are not required to take a physical strength test. Rappelling training instructors, (some are smokejumper instructors) train at the Regional Base. Rappellers have a physical training program similar to smokejumpers.

2. Live rappel training - After completion of ground training, which involves at least 10 rappels from the rappel "letdown device" (somewhat like our smokejumper let-down device, between two poles), the rappeller graduates to the live rappel phase of training.

Rookie rappellers make a minimum of 4 live rappels before being certified. Experienced rappellers also make "4 refresher rappels."

E. Rappelling Helicopters

Aeroflot provides approximately 300 helicopters for the rappelling and helitack programs. The trend is away from the smaller, underpowered, reciprocal helicopters to larger, newer twin-engine turbine helicopters. By 1980 most of the small recipis will be replaced with larger turbines. Inquiry was made regarding the rappelling helicopter safety record. From what I was able to determine there have been no helicopter crashes or engine failures while in the rappelling-hover mode. The Soviets feel that the program is quite safe. The following helicopters are used for rappelling:

1. K-26

- (a) Engines - 2 reciprocal 325 hp each.
- (b) Speed - 98 mph.
- (c) Range with rappellers - 3½ hrs. plus 30 minutes reserve or 300-360 miles.
- (d) Service ceiling - 12,000 ft.
- (e) Cost - \$200 per hr. (approximate) including pilot, fuel and maintenance.
- (f) Number of rappellers - 6.
- (g) Special feature - Winch system (not used to rappel)
Personnel and cargo deployed through a hole in cabin floor.
- (h) Comments - Underpowered, will be replaced by 1980.

2. MI-4 (looks like Sikorsky-55)

- (a) Engine - 1 reciprocal.
- (b) Speed - 84 mph.
- (c) Range - unsure.
- (d) Service ceiling - unsure.

- (e) Cost - unsure.
- (f) Number of rappellers - 8.
- (g) Special features - unsure.
- (h) Comments - Underpowered. Being replaced by newer helicopter.

3. MI-8

- (a) Engines - Twin turbine, 1500 hp each.
- (b) Speed - 150 mph.
- (c) Range - unsure.
- (d) Service ceiling - about 14,000 ft.
- (e) Cost - \$725 per hr. (approximate) includes pilot, fuel, and maintenance.
- (f) Number of rappellers - 28.
- (g) Special features - large standup exit door.
- (h) Comments - Considered their best rappelling - general utility fire suppression helicopter. About 15-20 MI-8's are added to the fleet each year to replace the recips.
- (i) Internal load capability - 6600 lbs.

F. Rappelling Equipment

The rappeller is equipped very much like his United States counterpart. Standard equipment includes the following:

1. Descent device drum and rope. The rappelling rope and descent device are one unit. (see Exhibit 8). The unit consists of:

- (a) A 120 ft. flat, one inch wide, (non-tubular) nylon rope with a tensile strength of 1650 lbs. One end of the rope is snapped to the helicopter. The other end is anchored to the center axle of the drum.

NOTE: When asked why the rappel rope was not longer, the answer was "due to helicopter performance." However, the 120 feet does enable a rappel into most Soviet timber areas.

- (b) A braking device (see diagram).
- (c) A metal drum (case) to house the rope. The drum is about 15½ inches in diameter by 1¼ inches thick. Webbing anchored to the descent device is attached (snapped) to the rappel harness.

- (d) Function - The drum is snapped to the rappel harness and is worn in front of the rappeller about stomach high. One end of the descent rope is snapped to the aircraft and the "drum webbing" is snapped to the rappel harness. The descent is controlled manually by a handle type brake. The rappeller's descent is stopped if he releases his grip on the control handle or if he moves the handle lever to the full-down position. The maximum rate of descent, I was told, is controlled at about 22 ft. per second by an internal friction brake. The standard rate of descent is about 7 feet per second.

The unit is designed for a 225 lb. person. Each person is assigned his own descent drum. The descent drum with rope weighs 18.5 lbs.

NOTE: The Sky-Genie was demonstrated and some of the Soviets tried it. The Soviets are very interested in this system.

2. Rappelling Harness

The rappelling harness is very light weight and has three attachment snaps. There is no "emergency release." The harness comes in one standard adjustable size.

3. Protective Helmet

The helmet is similar to the jumper helmet except the rappeller helmet has a clear plastic detachable or retractable face mask instead of the metal mesh screen.

4. Rappelling Gloves

The gloves are the same as those used by smokejumpers. The rappeller does not grip the rope to "brake himself" as with the Sky-Genie system.

5. Rappelling Boots

The pull-on high top "jumper boot" is also worn by all rappellers.

6. Cargo Bag

A bag similar to the smokejumper cargo bag is used to deliver fire and personal equipment.

7. Cargo Descent Device

The personnel descent drum is also used to deliver cargo. The descent device drum remains attached to the aircraft and the rope is snapped to the cargo bag. Upon reaching the ground the rope is unsnapped and the cargo dropper retrieves the rope back up into the aircraft (by hand). Two to three drums may be required to deploy all of the cargo. Before reuse the rope must be rewound into the drum.

G. Fire Equipment

Rappellers use the same fire equipment as smokejumpers, including extensive use of fire-line explosives.

H. Policies, Regulations & Standard Operating Procedures

1. Rappellers are routinely used to patrol and make initial attack on fires they detect. Often times jumpers and rappellers make a joint attack on the fire.
2. Rappeller Squad Size - Rappellers, like jumpers, are organized into squads. The squad size is dictated by aircraft capacity, burning conditions, etc. Usually a squad is 6 to 8 rappellers.
3. Regulations: Rappel Spot Selection
 - (a) Rappels will not be made if the helicopter can land within 1.2 miles of the fire. On a "critical fire" this distance may be reduced.

NOTE: The average number of rappels made by a rappeller in a season varies greatly depending on the obvious factors - number of fires, availability of natural openings, etc.

Rappellers usually land and walk to more fires than they rappel to.

- (b) Rappelling does not require an opening. Rappels can be made into a timber density of up to 70 %. Solid, overlapping tree crowns restrict rappelling.
- (c) Rappels can not be made if timber heights exceed 94 feet.

NOTE: The average rappel is made from about 100 to 110 feet above the ground. Each helicopter is equipped with an electronic altitude measuring device, accurate to within 3 feet.

- (d) Environmental Temperature - Rappels cannot be made in temperatures less than 32° F (0° C). The concern is that the nylon rope, perhaps from previous overheating and melting, may become brittle and break under cold conditions.
- (e) Minimum distance from the fire - rappels must be made at least 220-330 yards from the fire.
- (f) Wind conditions - There are no maximum wind velocity limitations for rappelling.
- (g) Slope - There are no maximum % of slope restrictions.

4. Safety

One area of concern expressed by the Soviet rappellers are emergency procedures while descending on the rope. In the event of a "jammed descent device" or "unable to procede" the rappeller must be retrieved into the aircraft by hand or he is lifted out into an opening. The rappeller does not have a good way to "jettison" himself in the event that he must free himself from the helicopter or harness.

Only two malfunctions of the descent device were reported. One involved a rappeller greatly exceeding the standard descent rate (7ft. per second) and rapidly applying the brake. The rope inside the drum continued to unwind and jammed inside the drum. The rappellers could not continue his descent. A second malfunction involved a rope that was melted due to overheating. The rappeller was seriously injured. A new descent device design has corrected this problem.

A major concern expressed by management level personnel was that the reciprocal helicopters lack performance and under high density altitude conditions down loading or "shuttling" crews is necessary. Our feeling was that perhaps their standard loads (number of rappellers per aircraft) was too high.

I. Mission Sequence

The pilot observer supervises the mission in much the same manner as he does in the smokejumper mission. Arriving in the fire area the pilot observer determines whether or not to land or rappel. If the decision is made to rappel the exact rappel spot is selected, altitude is electronically determined and the helicopter positions itself over the rappel spot. After "setting up," the following procedures are followed:

1. The senior instructor/instructor safety checks the rappeller. The instructor (spotter) wears a safety harness during the mission.
2. The instructor, in indirect communication with the pilot observer, then proceeds with deploying the men and cargo.
3. The exit door is opened.
4. One rappeller attaches the rappel rope snap to a hard point on the helicopter. All helicopters used have only one exit door and only one man is deployed at a time.

NOTE: The MI-8 has an "arm" mounted perpendicular to the exit door. The rope is snapped into a carabiner and the rappeller steps out of the exit door and descends.

5. Rappeller descends in a controlled descent at a rate of about 7 ft. per second. A controlled descent is stressed. The descent device has two "full brake" positions, fullup and full down. The descent rate is easy to regulate.
6. Rappelling rope is unsnapped. Once on the ground, the instructor unsnaps the rope from the helicopter and drops it to the ground. The rappeller straightens the rope and, using a handle, winds the rope back into the drum.
7. Next man repeats the sequence.
8. Cargo is deployed using the procedure outlined in the discussion on Cargo Descent Device, pg. 33. The cargo is deployed. A sandbag is attached to the end of the rope to prevent it from going into the rotors when it is retrieved.
9. Instructor rappels. After the cargo is deployed the instructor makes his descent and the mission is complete.

The total time to rappel 6 rappellers and standard cargo (2 bundles) is approximately 6 minutes.

IV.

PROGRAM IMPROVEMENTS

As we met with the various Soviet air personnel we discussed our programs and identified areas where improvement should be made. Listed below are some improvements in the Soviet programs that were identified by various Soviet jumper and rappeller personnel.

A. Improvements: Smokejumper Program

1. "Forester" Parachute -
 - (a) Reduce the descent rate slightly.
 - (b) Attempt to lessen the oscillation problem when recovering from a rapid turn.
2. Aircraft - replace the AN-2 with a faster aircraft capable of carrying more than 6 jumpers.
3. Jumper retrieval system - somehow develop a system to retrieve jumpers more easily and more quickly. The suggestion was an aerial "pickup system."
4. Replace the mesh screen on the jump helmet with a non-scratch plastic face mask or other material to improve the jumper's visibility during descent.

B. Improvements: Rappelling Program

1. Replace the older, poor performance helicopter with higher performance modern turbine helicopters.
2. Replace the smaller helicopter (6-8-rappellers) with helicopters capable of hauling more rappellers.
3. Develop a helicopter retrieval system (hover vertical recovery system).
4. Develop a descent device (drum) that is "malfunction-proof."
5. Develop a backup system in case the descent device fails.
6. Develop better procedures for retrieving a rappeller in the event he has a malfunctioned descent device or is unable to proceed with his descent.

V.

PROGRAM RECOMMENDATIONS-CONSIDERATIONS

Although I have had only a mere exposure to the Soviet smokejumper-rappeller programs I do feel that we should at least discuss and consider the following item, in total or in part, for possible adoption in our program. A smokejumper or rappeller workshop would be an appropriate place to initially discuss the item or procedure. My recommendations for further consideration are:

A. Smokejumper Program

1. Thoroughly examine the "Forester" parachute with the idea of incorporating some of its principles in the design of the new Forest Service parachute. We should specifically be concerned about the following features.
 - (a) Use of low porosity materials and "0" porosity materials.
 - (b) Construction of and location of the various porosity materials.
 - (c) Canopy modifications to achieve vertical descent and reverse.
 - (d) Color coding the toggle line.
 - (e) Attachment of the toggle line to the slot.
 - (f) Color code marks on the shroud lines to aid in rigging.
2. Consider constructing the reserve canopy with a combination of low porosity nylon and "0" porosity nylon (skirt and apex) and 1.1 rip-stop (central area).
3. Consider using the "Vane-scoop" type pilot chute on the reserve parachute.
4. Serious consideration should be given to requiring an electronic altitude measuring instrument on all smokejumper aircraft. This will reduce the chance dropping jumpers below minimum altitude.
5. Evaluate the Soviet smokejumper letdown system (descent device with control lever).

B. Rappelling Program

1. Evaluate the Soviet personnel descent braking device.
2. Evaluate the Soviet method of deploying cargo using the Soviet personnel descent device. Evaluate the same principle using the Sky-Genie (possibly using a smaller Sky-Genie and rope).
3. Consider requiring an electronic altitude measuring instrument on all rappelling helicopters.

VI.

SOVIET AIR OPERATIONS

This section of the report pertains to just a few of the policies, regulations, and bits of information that might interest our airmen.

A. Pilot Duty Limitations

1. Fixed wing pilots.
 - (a) Maximum flight hrs. per day - 8 hrs.
 - (b) Maximum flight hrs. per month - 100
 - (c) Days off - one day in 10.
2. Helicopter pilots.
 - (a) With two pilots - large helicopters.
 1. Maximum flight hrs. per day - 7 hrs.
 2. Maximum flight hrs. per month - 70.
 - (b) With one pilot - small helicopter.
 1. Maximum flight hrs. per day - 6 hrs.
 2. Maximum flight hrs. per month - 70.
 - (c) Days off - 1 in 10.
3. Exceptions.

The Civil Aviation Division will make some exceptions to daily and monthly maximum limitations. Under fire emergencies, with special permission, a maximum of 10 flight hours may be granted but the number of flight hours on the following day(s) will be restricted. Up to a monthly maximum of 130 flight hours may be granted to fixed wing pilots under fire emergency conditions.

B. Fitness For Duty

Before each flight the pilot (and crew) are given the pre-flight medical examination as outlined on page 23. Consumption of alcohol is not allowed on the day before or the day of the flight.

C. Aircraft Inspection

Inspections are generally set up at 100 hr intervals. Aeroflot does the maintenance.

D. Early Retirement

Fixed wing pilots are entitled to early retirement, (one year service equals one and one-half year) if the pilot flies over 300 hours per year. Helicopter pilots are entitled to early retirement if they fly over 200 hours per year.

E. Protective Clothing

Nomex or fire proof clothing, helmets and gloves are not required to be worn by pilots.

VII.

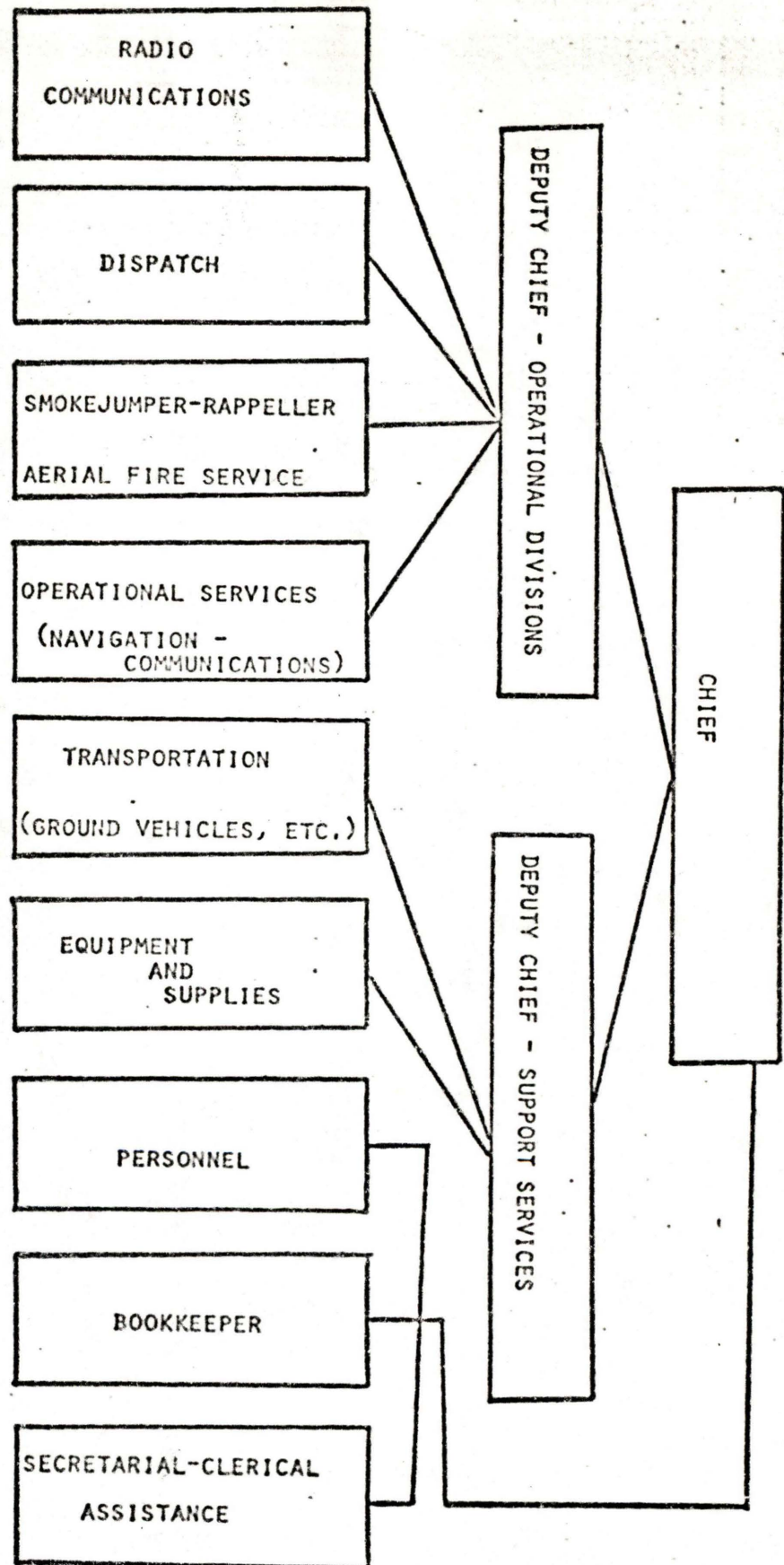
CONCLUSIONS

The Soviet smokejumper and rappelling programs appear to be very effective programs. Personnel involved in these programs are well trained and knowledgeable about their programs. Esprit de corp, morale and dedication are high. The people in these programs have a great deal of pride in the job they are doing.

The Soviet programs, like our programs in the United States, have some areas needing improvement. We are both aware of these areas.

I feel that this technical exchange was a most worthwhile venture and that both the United States and the Soviet Union have benefited from the program.

EXHIBIT 1



IRKUTSK REGIONAL BASE

(SAMPLE)

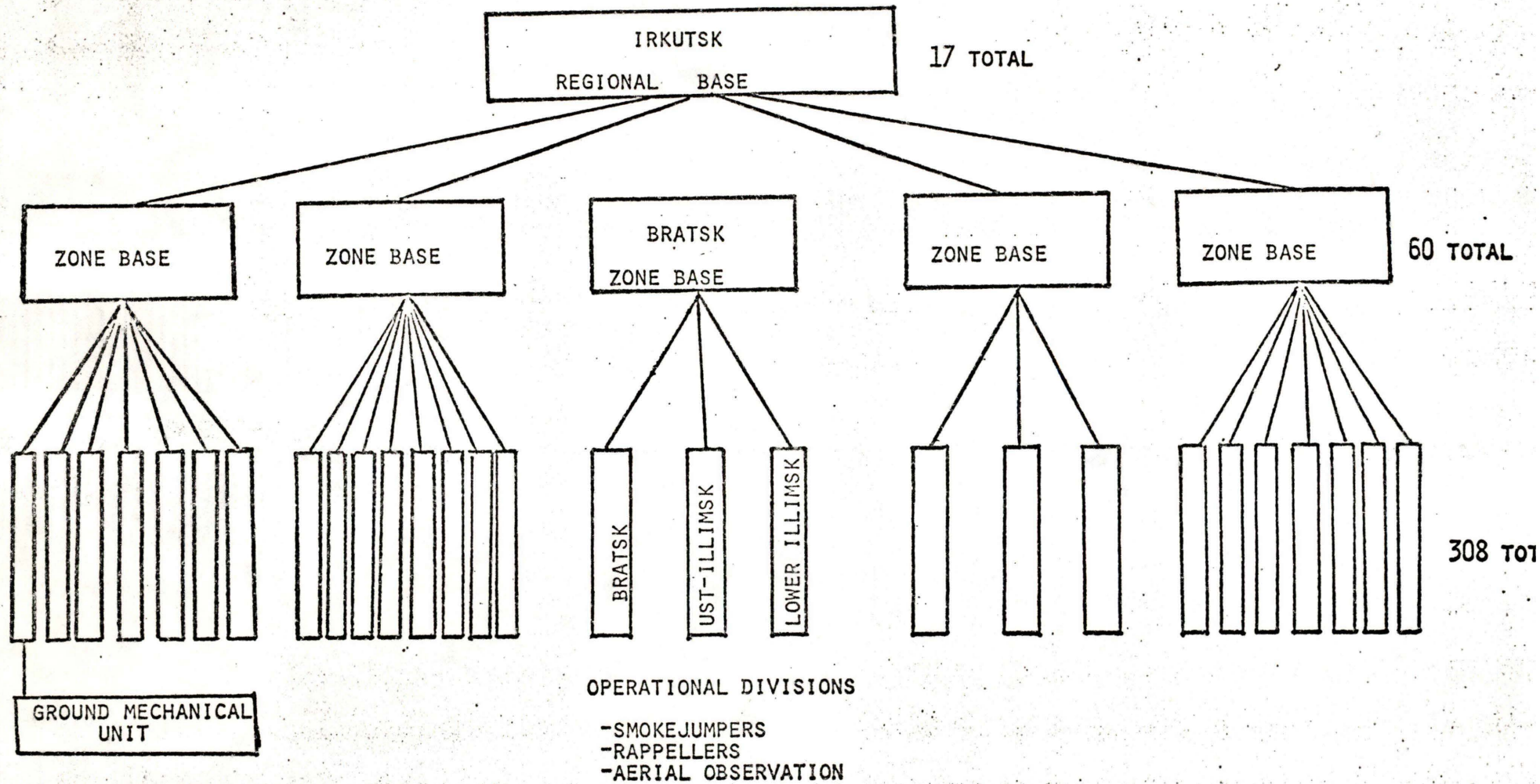


EXHIBIT 3
THE "FORESTER" PARACHUTE

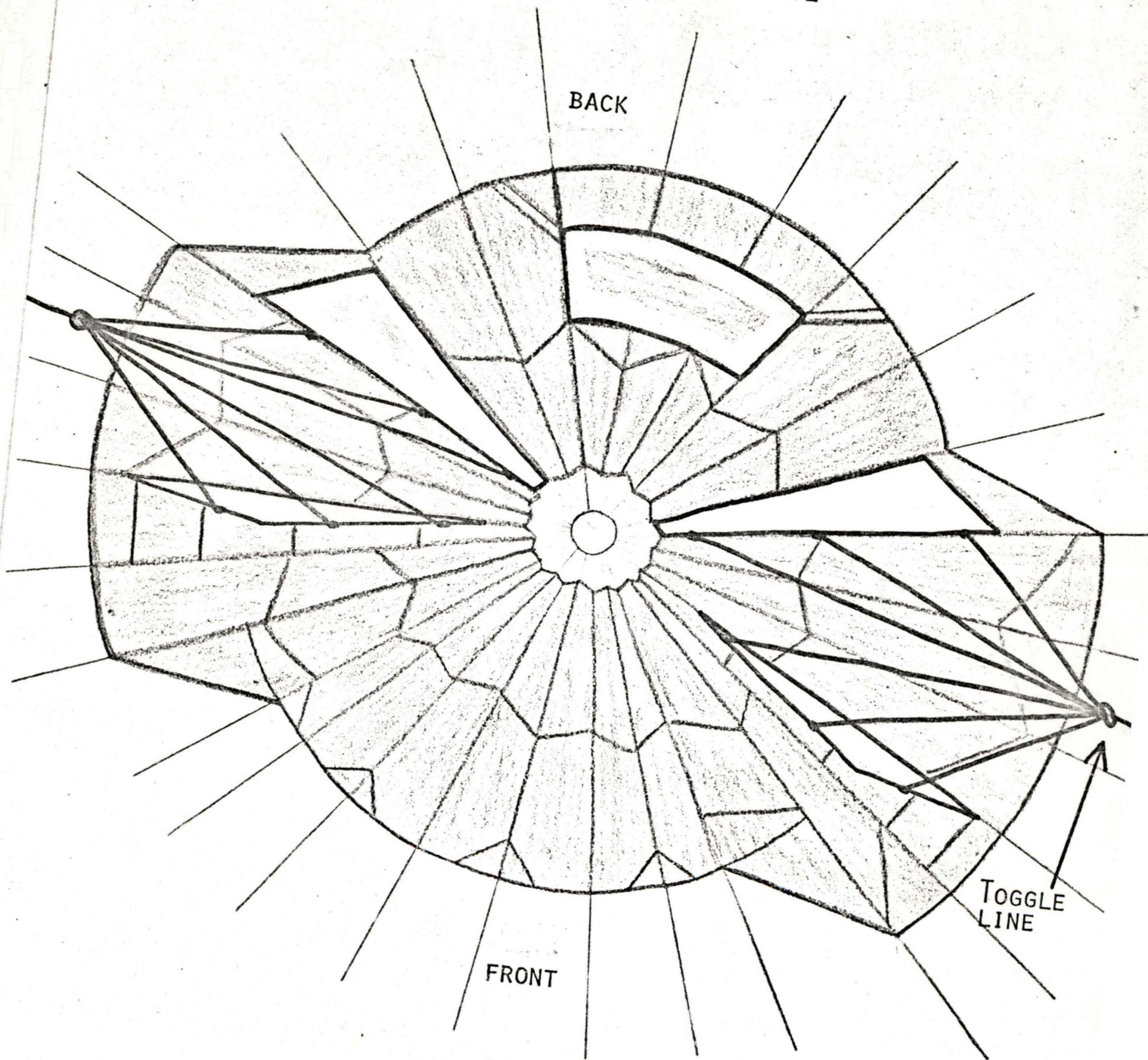
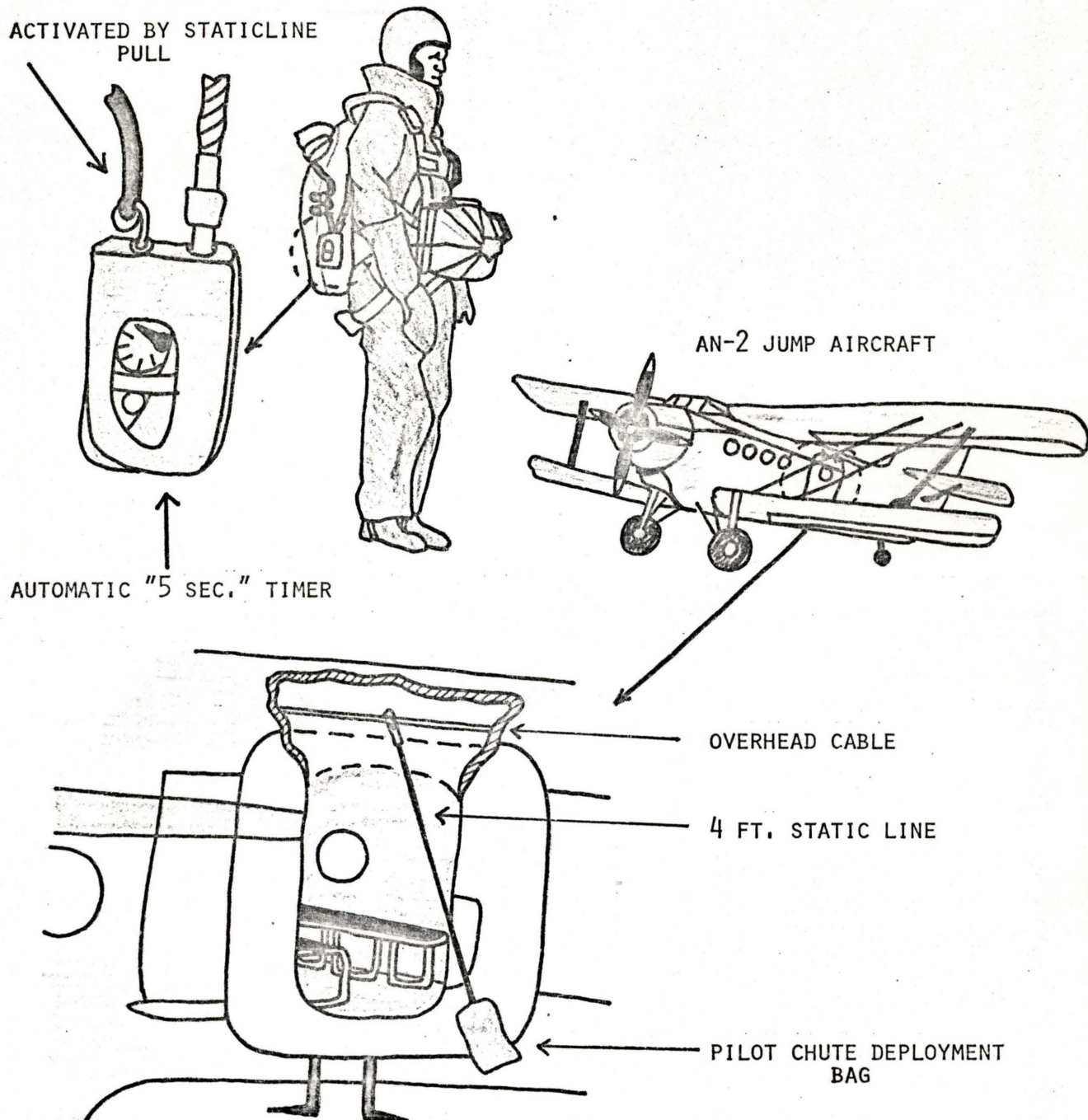
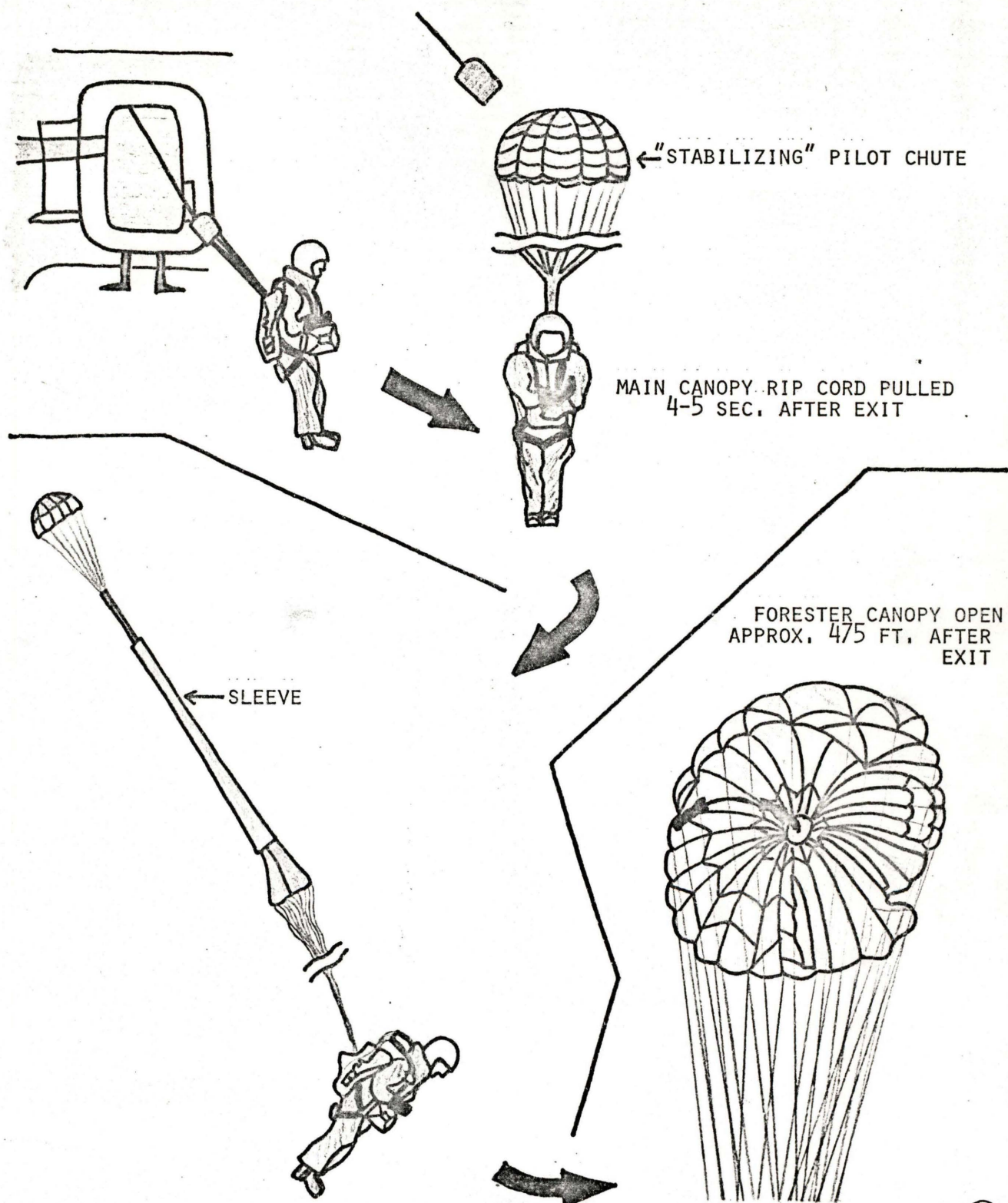


EXHIBIT 4
SOVIET "FORESTER" PARACHUTE DEPLOYMENT SEQUENCE



"FORESTER" DEPLOYMENT SEQUENCE



Illustrations by Barry George, NCSB

EXHIBIT 5
SOVIET RESERVE PARACHUTE

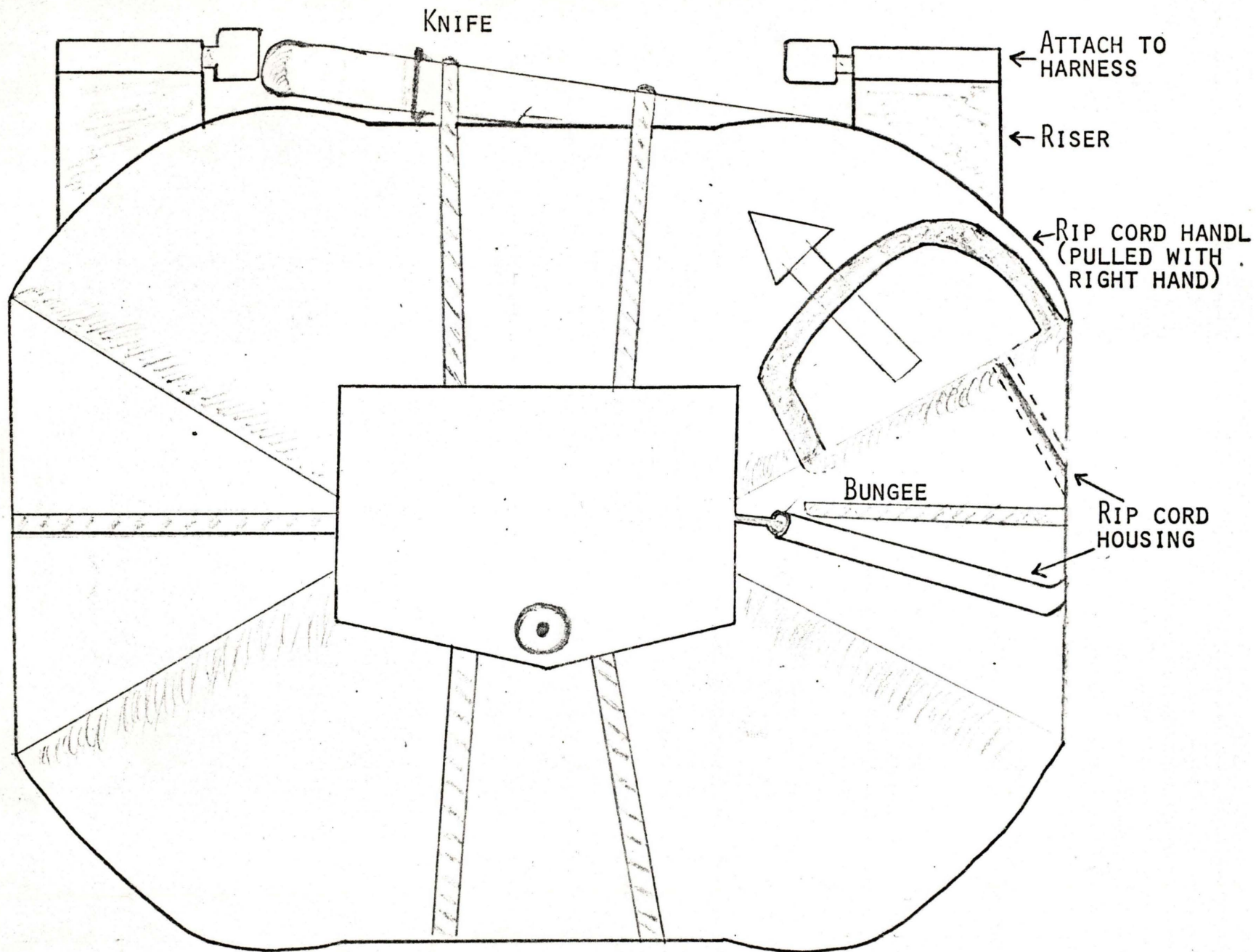


EXHIBIT 6
SOVIET SMOKEJUMPER LETDOWN DEVICE

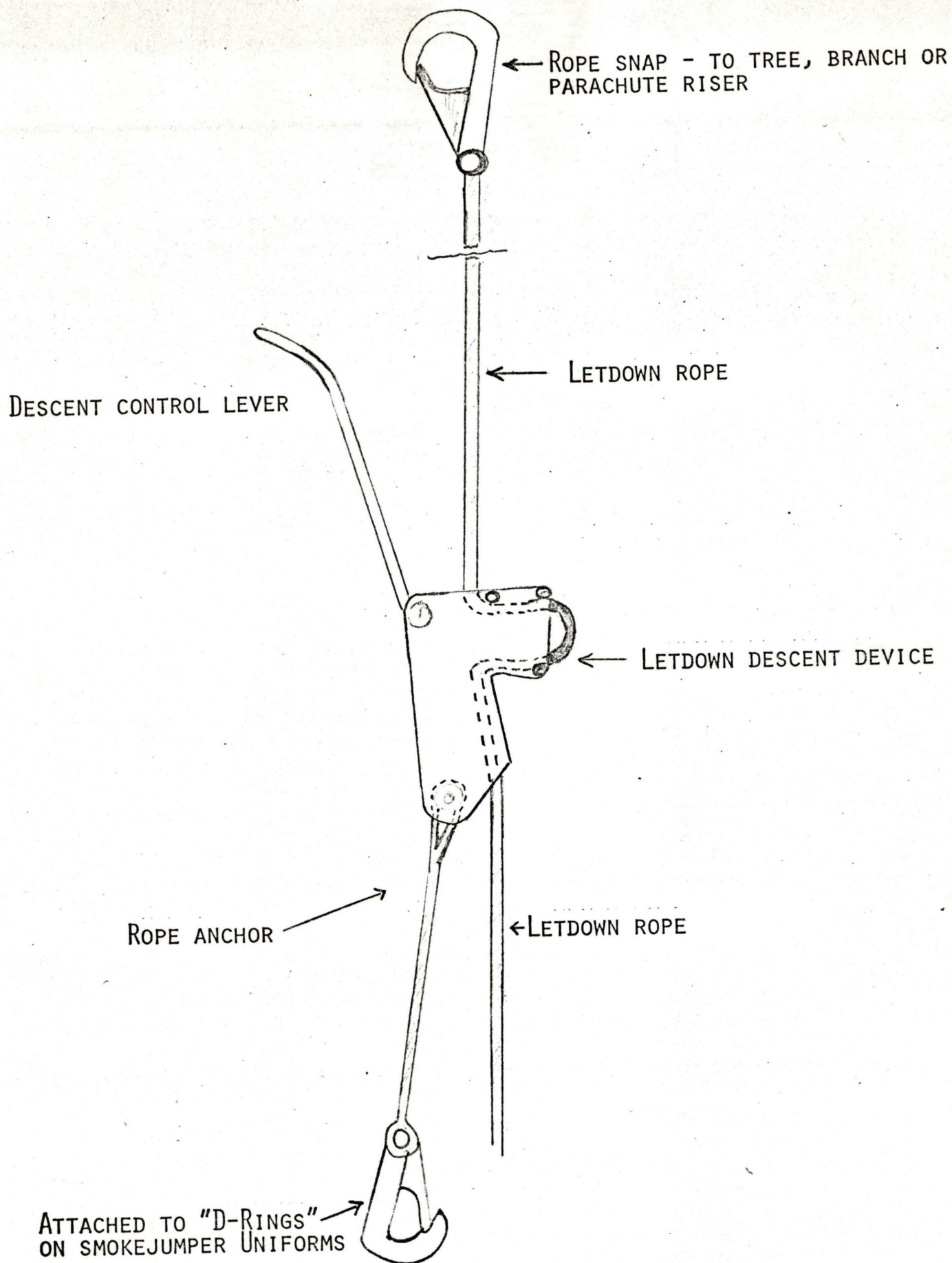
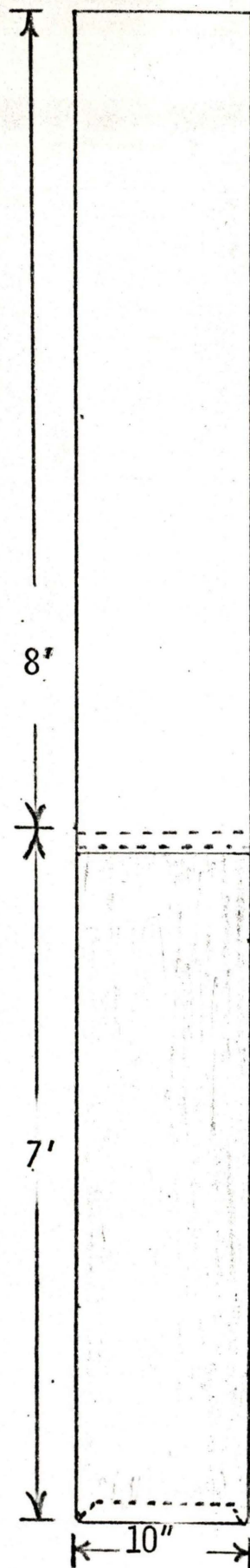


EXHIBIT 7

SOVIET DRIFT STREAMER



STITCHING-JOINS DIFFERENT COLORED LENGTHS

STITCHING-SECURES $8 \frac{1}{4}"$
($1 \frac{1}{2}$ OZ. ROD)-1' CREPE PAPER
ROLLED UP AROUND WIRE

EXHIBIT 8
SOVIET RAPPELLING DESCENT DEVICE

